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AIRCRAFT AND SPECIAL EQUIPMENT CENTER
Bureau of Entomology and Plant Quarantine
AGRICULTURAL RESEARCH SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

ANNUAL REPORT
Calendar Year 1953

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INTRODUCTION

The primary functions assigned to the Aircraft and Special Equipment Center when it began operation early in 1951 can be placed in four general categories:

(1) Improving the quality and utilization of the Bureau's pest control equipment.

(2) Improving the efficiency and safety of application methods.

(3) Advising the public on pest control equipment and methods of using it.

(4) Assisting Department agencies with technical supervision and supplying aircraft for cooperative pest control and survey programs.

To effectively discharge these responsibilities progressive changes have been required. Sixteen of the 26 airplanes operated by the Bureau in 1950 have been disposed of. In 1950, 14 of the 26 were used for the actual application of insecticides. In 1953, only 4 were so used. To meet an increasing need for aircraft of wider use in Bureau work, 3 additional cabin-type units were acquired.

These adjustments were made because the need for aircraft in survey, reconnaissance and supervisory work was increasing greatly whereas commercial applicators were becoming better able to perform the specialized work required in cooperative control programs.

A progressively increasing amount of time has been spent in improving the Bureau's special-purpose ground equipment. This is a result partly of reduced field facilities for equipment investigation and partly of new developments in pest control materials and methods.

The rapidly changing character of aircraft application equipment and the relative scarcity of published information on the subject have required that increasing attention be given to the dissemination of such information to the public.

Changes in emphasis, such as these, will continue to be required if service on equipment subjects is to keep abreast of new problems, new materials and new methods. Periodically, therefore, it is expected that a thorough appraisal of the Center's objective will be made.

ORGANIZATION

To initiate a progressive reduction in expenditures, in conformance with Department policy, reduction-in-force notices were given to two shop employees in October. Other employees were notified that further reduction might be required and that opportunities for employment elsewhere should be seriously considered.

On October 23, the clerk-storekeeper resigned to take employment with a commercial firm. The shop janitor resigned on November 13.

Due to resignations and reductions in force, personnel at the Center was reduced 27% during the last three months of the year.

Effective September 27, 1953, R. A. Tate of White-Fringed Beetle Control was reassigned to a position in which he acts in a liaison capacity between the Aircraft and Special Equipment Center and Region II. He works under the general administrative supervision of the Regional Director. The functions of his position are as follows:

1. Plans and conducts a program for the utilization, adaptation and maintenance of special

equipment and the maintenance of automotive equipment.

2. Tests specialized equipment to determine adequacy of performance from an engineering standpoint and recommends changes in design and structure to meet specific needs on pest control operations.

3. Appraises and recommends commercial equipment which could be adapted to field use.

4. Studies use of equipment and recommends transfer between projects for fuller utilization.

5. Investigates items or details of equipment and makes recommendations that may improve Bureau control activities.

6. Represents the Aircraft and Special Equipment Center by evaluating the need for special equipment to perform unusual functions.

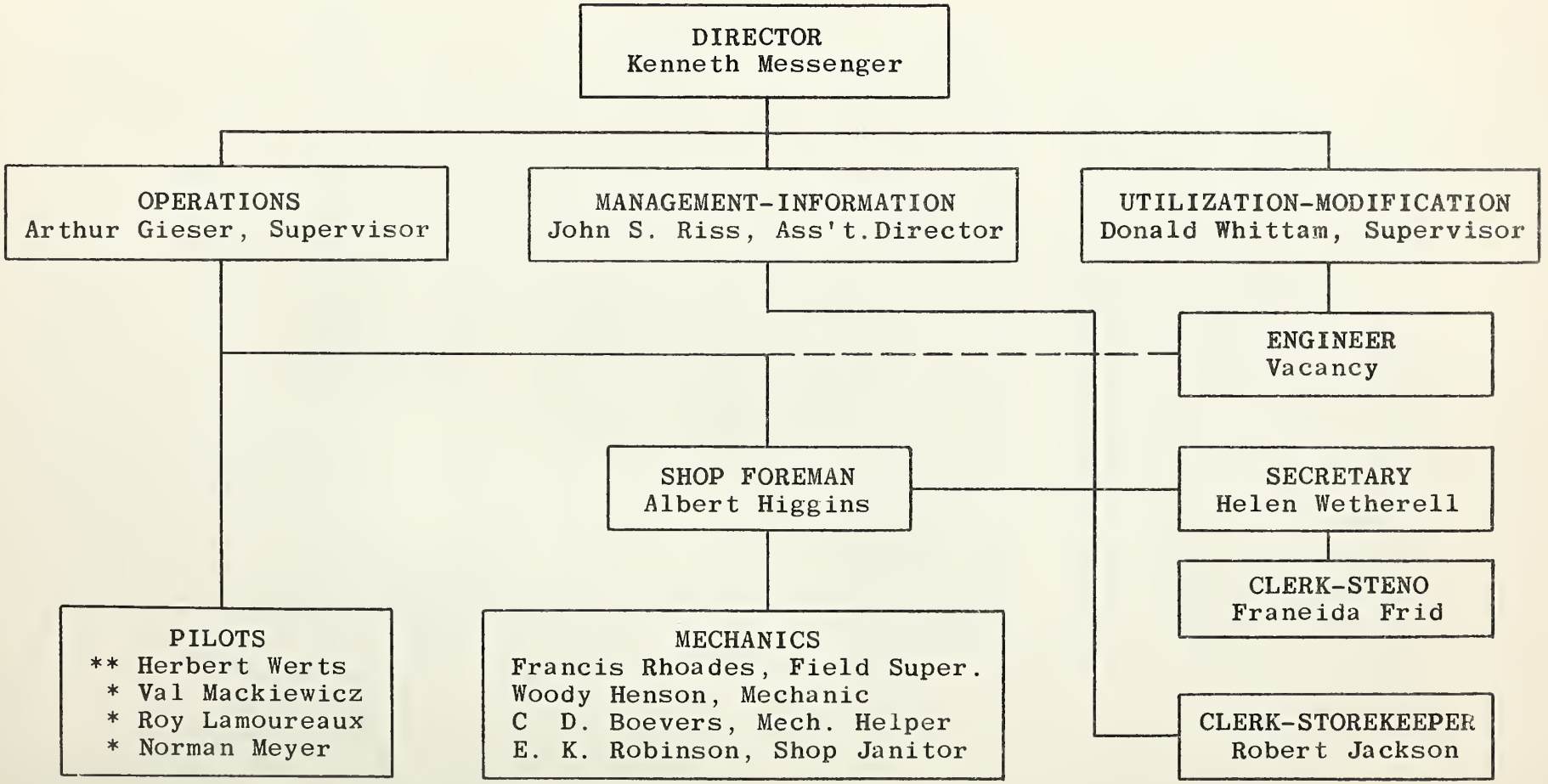
7. Serves as technical advisor to Regional Director and staff on use of equipment under various field conditions and is responsible for the promotion and adoption of safety techniques.

8. Attends spray schools and similar meetings to describe effective application equipment and methods; trains and supervises assigned personnel.

This arrangement has worked well and at the end of the year consideration was being given by the other Regional Directors for the establishment of similar positions within their respective Regions.

ORGANIZATION CHART

AIRCRAFT & SPECIAL EQUIPMENT CENTER
Bureau of Entomology & Plant Quarantine
U. S. Department of Agriculture



* Alternates As Mechanic When Not Flying
** On Military Leave

Five different individuals were employed as temporary pilots in 1953 to assist on control programs--two as co-pilots for the Douglas C-47s and two for the N3N and Stearman. One was used as a replacement for another who, considering the work too hazardous, resigned in mid-season.

The offices of the Center were moved from Cimarron Field to a government-leased building in Oklahoma City in April 1953. This move served the convenience of visitors and office personnel alike. It did not increase operating expense.

EDUCATIONAL AND INFORMATIONAL SERVICE

During 1953, information on the use of aircraft and special purpose field equipment for insect control, surveys and research, was furnished to Bureau, other Federal, state and cooperating agencies, the public and foreign interests. 3/4 of the requests for information concerned aircraft; 1/6 were from foreign countries. Very few were routine. Replies in some cases could be made adequately only after considerable investigation.

Of those who visited the Center during the year, approximately 25 percent were Bureau people or associated with other Bureaus of the USDA. The remainder were aerial applicators, persons associated with state agricultural departments, and representatives of foreign interests.

The Center offered assistance to other Bureau agencies by providing information on manufactured products. In this connection the Center has built up a rather complete file of the various types of special field equipment appearing on the market, listing sources and specifications. This has proved of value in furnishing information on new machines as well as on the improvement or modification

of old ones. Because of the rapidly expanding nature of the equipment industry, the acquisition and current maintenance of such specifications has required greater diligence than was anticipated.

Upon request, recommendations and suggestions for the design of new agricultural aircraft and equipment installed in them were furnished to three manufacturers:

The president of Central Aircraft requested personal assistance on a plane being designed by Central-Lamson Aircraft, Inc., Yakima, Washington. On two different occasions, personnel from the Center, in connection with other work in the northwest, visited the plant to discuss the plane's dispersal apparatus. The first unit, called the "Air Tractor", was flight tested December 11, 1953. Its performance is reported to have exceeded the designer's expectations.

An agricultural airplane, that reportedly will be called the Ag-2, has been designed and will be constructed by the Transland Company of El Segundo, California. On request, suggestions were furnished for the dispersal equipment in this airplane. The Ag-1 airplane, designed specifically for agricultural work and almost totally destroyed when it collided with a power-line pole near Lubbock, Texas, June 26, 1953, was purchased by this company. They have incorporated its most desirable features in the new design.

Several inquiries were received from Alaska Airlines for suggestions for an airplane they expect to design. Their intention is to develop an airplane that will be a real work horse in the bush country and at the same time be well adapted to agricultural work. The design fitted Forest Service requirements so closely that the original request was referred by the Center to the Forest Service for additional suggestions.

The Center's director served on the Aviation Committee of the Oklahoma Chamber of Commerce and on a special Mayor's committee appointed to make recommendations on the local aviation industry's future course.

Other informational and educational assistance included attendance at pest control schools and conferences, the issuance of publications, both by the Center and in cooperation with other agencies, and the demonstration of Bureau equipment at pest control meetings.

Meetings

Attendance at schools and conferences was, in most cases, by invitation and included active participation in the programs and discussions. Such meetings were sponsored by state agricultural colleges, national aviation associations, and aerial applicator organizations. A list of those attended follows:

Grasshopper Control State Leaders' Conference - Denver, Colorado

Agricultural Aircraft Association Convention - Fresno, California

Short Course on Aerial Spraying and Dusting - Logan, Utah

Aerial Spray Operator's Short Course - Lincoln, Nebraska

Second Annual Texas Agricultural Aviation Conference - College Station, Texas

National Agricultural Aviation Research Conference - College Station, Texas

Plant Pest Control Conference - Auburn, Alabama

Southwest Branch AAEE - Galveston, Texas

Fifth Annual Aerial Dusting and Spraying Conference - Yakima, Washington

Aerial Applicator's Conference of the Fourteenth Annual National Aviation Trades Association Convention - Wichita, Kansas.

Publications

During the summer of 1952 the Bureau of Entomology and Plant Quarantine entered into a contract with the University of Oklahoma Research Institute to prepare a bulletin containing general information on aircraft spraying from material supplied by the Aircraft and Special Equipment Center. The manuscript was completed late in January 1953 and submitted to Washington for approval. After it was reviewed by specialists within the Department, the Center worked with Bureau editors in making revisions and clarifications. The manuscript's tone and composition was designed for easy reading by the audience to which it was directed, namely the farmer and the aerial applicator. In style it was rather a radical departure from previous bulletins issued by the Department and therefore received more than average editorial attention. The approved manuscript, "How to Spray the Aircraft Way--for Agricultural Pest Control", went to the printer at the end of the year. It is planned that it will be published as a Farmers' Bulletin early in 1954.

The manuscript mentioned in the 1952 report describing the "Use of C-47 Airplane for Baiting and Spraying" was published in the 1953 issue of Agricultural Chemicals. Reprints for distribution to interested persons were furnished by the publisher.

An article entitled "The Use of Aircraft in Controlling Insects" was written, on request, for the "Sixth Annual Cotton Insect Control Issue" of the Cotton Gin and Oil Mill Press, dated March 14, 1953.

Information was furnished to a free lance writer who had been commissioned by Flying magazine to prepare an article on the Center's work. The article, on spraying and dusting by aircraft, was entitled "War for Acres". It appeared in the June 1953 issue.

Following numerous requests, an article describing a hydraulic-drive system for an aircraft spray or dust discharging mechanism was prepared for publication. It has been suspended temporarily to permit further field testing of the pilot installation.

Several manuscripts on insect control equipment subjects were referred by the Bureau editorial office to the Center for review.

Material prepared for a bulletin relative to a compressed-air type sprayer was reviewed at the request of the Barberry Eradication Project. This sprayer was found to be so similar to one now available on the market that the need for such a bulletin appeared questionable.

A short article on the use of the airplane in insect control was prepared for the Division of Information in Washington, D. C. for use in the "Fact Sheet" for the Entomology Centennial.

Three feature articles describing the work of the Center appeared in Oklahoma City newspapers.

Demonstrations

A Stearman airplane, equipped for spraying, was requested for demonstration purposes at the Utah Spray School held in late February. However, due to adverse flying conditions, it was necessary to leave the plane in Denver.

During January, Douglas airplane #1 and Stearman #6, using a colored-dye solution, were demonstrated at Wiley Post Airport in Oklahoma City before the Governor and other state officials interested in agricultural aviation.

The Stearman airplane with high-lift wings was exhibited during the Second Annual Texas Agricultural Aviation Conference at College Station, Texas.

May 8-10 the Center participated in the Oklahoma City Air Fair by designing and installing a popular exhibit that included a stripped-down Stearman sprayer with placards identifying various sprayer components. Another Stearman sprayer made one spraying demonstration each afternoon using a colored-dye solution. The director of the Center, as a member of the Aviation Committee of the Chamber of Commerce, assisted in the general planning of the Fair. The three-day attendance was approximately 100,000.

Several aerial applicators who visited the Center during the year for information relative to aircraft spraying and dusting were permitted to fly the Stearman with the high-lift wings. Their comments were favorable.

COOPERATIVE ACTIVITIES

Technical assistance and equipment facilities of the Aircraft and Special Equipment Center were made available to several Bureau agencies and other Federal, state

and cooperating activities. Supervisory assistance was provided on several control and survey programs. Aircraft and pilots were assigned to control, survey, research and reconnaissance work. (See p. 12) Advice was given on the selection of new equipment and on the maintenance and modification of equipment in current use.

To permit the Center to evaluate fully the suitability and degree of utilization of special-purpose equipment within the Bureau, a Special Equipment Annual Report form was prepared to provide information not available on the inventory form AD-106. The suggested form provides for the description, specifications, condition, use-period and location of each piece of equipment. The form was submitted to the Administrative Services Division for consideration and approval.

Several forms such as the Daily Aircraft Line Inspection Form, to be used by contract airplane operators, and the Aircraft Daily Operation Record, for Government aircraft, were revised. Proposed instructions for "Policy on Use of Bureau Aircraft" and pilot qualifications for Bureau pilots, GS-9, were reviewed and criticized at the request of the Administrative Services Division.

It was found at the bid openings on the Mormon cricket control program that one or two points in the contract form had been misinterpreted. In an effort to prevent such misunderstandings in the future, as well as to condense and simplify the contract, it was restudied and rewritten at the close of the 1953 control season.

During the year, specifications for special equipment, in connection with purchases, were reviewed at the request of the Administrative Services Division.

Detailed information concerning a relatively new method of propulsion for shallow-draft boats was obtained and reviewed for the Pink Bollworm Control Project. The

AIRCRAFT ASSIGNMENTS DURING 1953

MAKE	BEPQ NO.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Douglas	1	P		P	A	A A	A G	H H	I				
Douglas	2				P	C C	C F	H H	I				P
Cessna	3					B B	L L	O N	N L	L L	L		
Cessna	4	K K	K K	K		K K	K K	K K	K K	K	K		
Cessna	5			P			L L	L L	L				
Stearman	6		P			P P	E G	G H	I J				
Stearman	7		P				P			P			
Stearman	8					P	P	P	P				
Stearman	9	P			P	P	P	P	P	P	P	P	
Stearman	10*										P	P P	
N3N	11				P A	A A	E G	F F	I				
Cessna	12						O	O L	L L	M	M		
N3N	13			P	P	P P	P P	H P	P P	P			
Piper	14	P			D	D D	K	K K	P				

PROJECT	WORK LOCATION	CODE
M.Cricket	Nev.Calif.Colo.Utah	A
M.Cricket	Contract Supvsn.	B
Gypsy Moth	New England States	C
Gypsy Moth	Contract Supvsn.	D
Grasshopper	Arizona	E
Grasshopper	Utah	F
Grasshopper	Texas	G
Grasshopper	Colorado Idaho	H

PROJECT	WORK LOCATION	CODE
Grasshopper	New Mexico	I
Grasshopper	Wyoming	J
Forest Insect Survey	United States	K
Forest Insect Survey	Ore.Wash.Calif.	L
Forest Insect Survey	Ariz. N.Mexico	M
Forest Insect Survey	Minn. Wisconsin	N
Spruce Budworm Supvsn.	Oregon	O
Tests, Experiments & Demonstrations		P

*Stearman BEPQ-10 in shop for modification during 1953.

system, using a jet stream of water rather than a conventional propeller, appears to have application in boat equipment of the type now in use on the wild-cotton eradication program by eliminating the fouling of the propeller in underwater growth.

Pump requirements for a small sprayer used by the Division of Stored Products Investigations at Houston, Texas were reviewed. A rotary-gear pump, surplus to the Center's needs, was transferred to them.

Specifications for a sprayer capable of handling concentrated suspensions were reviewed for the Fruit Fly Laboratory of the Fruit Insect Investigations Project in Honolulu, Hawaii. A list of firms, to whom a request for literature on a sprayer of this type had been sent, was reviewed and a similar request mailed to known manufacturers not included on the list.

A request was received from the Division of Fruit Insect Investigations for advice on converting a power duster to a mist blower for the Division's laboratory in Mexico City. The manufacturer was contacted to see if a standard adaptation had been produced to so convert this particular model of duster. It was learned that the manufacturer did have the necessary parts to make this alteration and the required information was furnished to the laboratory.

Upon request by the Regional Director in Region V, information on corrosion-proof paints for coating the inside of knapsack sprayer tanks was investigated and the most promising product recommended for test by the Barberry Eradication Project.

Johnson A. Neff, biologist for the Fish and Wildlife Research Laboratory, Denver, Colorado, came to Oklahoma City to discuss the part aircraft might play in reducing bird damage to rice through the application of repellents.

U. S. Air Force personnel from Wright Air Development Center at Dayton, Ohio visited the hangar and inspected spraying and baiting equipment in Bureau aircraft. They inquired into methods of using similar equipment for controlling insects in conjunction with military operations.

Recommendations for research that would increase the safety of agricultural aviation were furnished, on request, to the Flight Safety Foundation, New York City.

Because of the growing evidence that two-way radios could serve a useful purpose in agricultural aviation, the Center initiated some investigative work in determining which frequencies would be most suitable. Toward this end, the thinking of several aerial applicator companies, agricultural aircraft associations, the CAA and other Bureau agencies using airplanes was solicited. The Administrative Services Division cooperated by contacting the Federal Communication Commission. It was originally thought that a frequency in the VHF band would be most desirable so that one receiver and transmitter would serve for both navigation and agricultural operation. However, certain shortcomings of VHF, as opposed to the lower MF band, make a more thorough investigation of both bands desirable.

The Governor of Oklahoma requested the assistance of the Center's facilities in evaluating the use of both airborne and ground equipment for the control of grass and brush fires. The request, referred to the Chief of the Bureau for consideration, was discussed with personnel of the Division of Forest Fire Research in the Forest Service to determine their interest in the problem. It was determined that there would be no apparent reason why the Center could not cooperate in this matter provided the Forest Service requested such cooperation and the experimental work could be done without expense to the Bureau of Entomology and Plant Quarantine. This information was then referred to the Governor for suggestions as to the manner in which the work might be financed and for more complete information of its magnitude and scope.

AIRCRAFT OPERATIONS - 1953

Amount and Cost (in dollars) of Work Done by Aircraft Headquartered at the Aircraft and Special Equipment Center

Aircraft No.	Gas and Oil	Mtce. and Repair 1/	Engine Depreciation 2/	Aircraft Depreciation 3/	Pilot Salary & Expenses	Total Costs	Hours Flown	Cost Per Hour 4/	Acres Treated	Cost Per Acre	Proj.	Location
1	3804	2850	1068	2148	2241	12111	89		62691	.19	MCC	Nev. Cal. Colo.
	4396	3535	1418	2852	2484	14685	118		158963	.09	GHC	Tex. Colo. Ida. N.Mex.
Total	8200	6385	2486	5000	4725	26796	207	107	221654	.12 Av.		
2	2387	3345	734	1867	2711	11044	61		58735	.19	GMC	N.Eng.
	3990	4746	1240	3133	2659	15768	103		155416	.10	GHC	Colo. Ida. Utah N.Mex.
Total	6377	8091	1974	5000	5370	26812	164	131	214151	.13 Av.		
3	139	132	67	117		454	53		5/		MCC	Utah Nev. Ida.
	781	455	363	633		2232	290		6/			Ore. Wash. Minn. Cal.
Total	920	587	430	750		2686	343	8				
6	1847	1894	834	500	2254	7329	208	35	38346	.19	GHC	Ariz.Tex.Colo. N.Mex.Wyo.
11	691	454	293	77	1137	2652	73		6085	.44	MCC	Nev. Cal. Utah
	1723	1081	698	423	1218	5143	175		25060	.21	GHC	Ariz. Tex. Utah N.Mex.
Total	2414	1535	991	500	2355	7795	248	22	31145	.25 Av.		
12	191	103	117	263		674	47		5/		SpBdw	Ore.
	679	512	506	1137		2833	202		6/			Ore. Wash. N.Mex.
Total	870	615	623	1400		3507	249	14				
14	611	237	270	470		1588	270	6	5/&6/		GMC	N.Eng. Ore.

1/ Includes labor and expense of mechanics, hired maintenance and all parts.
2/ Engine depreciation computed on hourly basis for replacement or major overhaul.
3/ Aircraft depreciation based on the following aircraft values, amortized in 10-yr. period: C-47 #1 $50,000; C-47 #2 $50,000; Cessna #3 $7,500; Stearman #6 $5,000; N3N #11 $5,000; Cessna #12 $14,000; and Piper Cub #14 $4,700.
4/ Does not include pilot salaries and expense.
5/ Insect control contract supervision.
6/ Forest insect surveys.

CONTROL ACTIVITIES

Mormon Cricket Control

The Center participated in the planning of the 1953 Mormon cricket control work in Utah, Nevada, Idaho and Montana and gave technical assistance during the opening of bids for aerial contract baiting.

After contracts had been awarded inspection trips were made to the operating bases of successful bidders in Arizona, Montana and Utah to consult with the operators about their equipment and recommend alterations that might prevent unnecessary delays after reporting for work. Evidence that these pre-control inspections were of value lies in the fact that none of the contract aircraft was grounded due to installation failures.

A supervisory pilot and airplane were provided for final inspection and calibration of the contract aircraft at the work sites and for a check of their work once baiting had begun.

Douglas airplane #1 was used on the Mormon cricket control program in Nevada, California and Colorado. Because of delays in the arrival of the contract aircraft, it was used to advantage in baiting the most critical cricket populations to keep them from migrating and spreading. Later it was used to control Mormon crickets located in remote areas, sometimes more than 100 miles from the nearest bait station.

N3N airplane #11 was used in Nevada and Utah to control small and isolated bands of Mormon crickets that could not be controlled economically with large aircraft. It was also used to clean up small pockets of crickets after the large aircraft had completed their assignments.

Grasshopper Control

Four aircraft, equipped as sprayers, six pilots and two mechanics were assigned to grasshopper control. The aircraft included the two Douglases, a Stearman and an N3N. They worked on projects in Arizona, Utah, Texas, Colorado, Idaho and New Mexico. In addition, technical assistance was provided to inspect spray aircraft that had been contracted for grasshopper control in Colorado.

Gypsy Moth Control

The Douglas spray-plane #2 with crew (two pilots and a mechanic) was made available for gypsy moth control spraying conducted cooperatively with the States of Massachusetts and New York. The Piper Super-Cub with pilot-supervisor was assigned to inspection of contract equipment and supervision of spraying done by contract aircraft in Pennsylvania, New York, Connecticut, Vermont and Maine.

Spruce Budworm Control

Technical supervision, including a Bureau airplane, was furnished the U. S. Forest Service prior to and during the spruce budworm control program in Oregon. For the second consecutive year this program was completed without a pilot injury or fatality.

The U. S. Forest Service requested assistance in planning a sage-brush eradication program in southern Oregon and northern California. The proposed spray area was inspected to determine whether the type of airplane proffered by the low bidder could be used. The successful bidder's base of operations was also visited to inspect his equipment. Suggestions were made at that time for equipping it satisfactorily. Two successive trips were made to insure its capability.

Japanese Beetle Control

After a serious Japanese Beetle infestation had been discovered between Sheldon, Illinois and Kentland, Indiana, the Center was asked to participate in a meeting that was called to consider an experimental control program. Those in attendance included other representatives of the Bureau of Entomology and Plant Quarantine, the Indiana State Entomologist, the Illinois Department of Agriculture, and the Illinois Natural History Survey.

Japanese beetle traps were again set out at Tinker and Will Rogers Fields near Oklahoma City during the summer of 1953. Air Force personnel tended the traps at Tinker Field and personnel from the Center tended those at Will Rogers Field.

Pine Butterfly Control

A program for pine butterfly caterpillar and spruce budworm control in the Boise and Payette National Forests in Idaho was contemplated for 1954. In October, assistance was given to the Forest Insect Investigations Laboratory of Ogden, Utah and the U. S. Forest Service office at Boise, Idaho in making initial plans for this program.

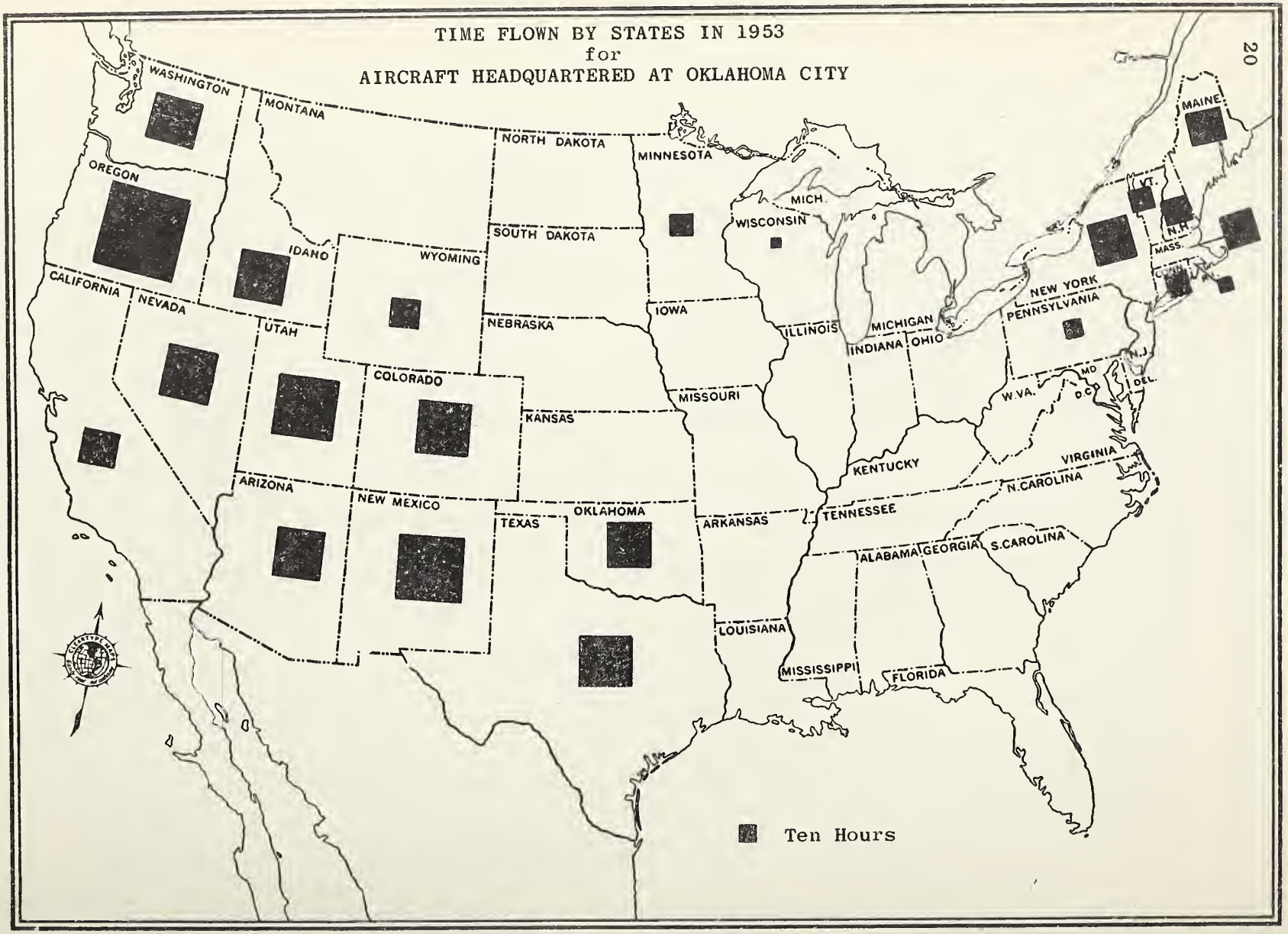
Because of the rugged terrain, it was necessary to fly over the areas to be sprayed and determine the types of contract aircraft that could be used effectively and safely. At the same time, the various airstrips in and near the spray sites were viewed from the air to determine which ones, if any, could be used by the spray aircraft. Locations where additional airstrips could be built were also mapped. These locations were later inspected from the ground and final recommendations offered for making them usable.

Contract specifications were discussed and preliminary costs estimated.

TIME FLOWN BY BUREAU AIRCRAFT IN 1953

TYPE AND	CAA NO.	BEPQ NO.	HEADQUARTERED AT	TYPE OF WORK	HOURS
Douglas	75029	1	Oklahoma City	Spraying-Baiting	207
Douglas	816	2	Oklahoma City	Spraying	164
Cessna	2234D	3	Oklahoma City	Supervising-Surveying	343
Cessna	9354A	4	Beltsville	Photographing-Surveying	275
Cessna	2494D	5	Portland	Photographing-Surveying	229
Stearman	55692	6	Oklahoma City	Spraying	220
Stearman	1380V	7	Oklahoma City	Spraying, Experimental	37
Stearman	9487H	8	Beltsville	Spraying, Research	7
Stearman	9488H	9	Beltsville	Spraying, Research	26
Stearman	1218N	10	Oklahoma City	Granular Dispersal Tests	6
N3N	45009	11	Oklahoma City	Spraying-Baiting	248
Cessna	1643C	12	Oklahoma City	Supervising-Surveying	249
N3N	45036	13	Forest Grove	Dusting & Spraying, Research	80
Piper	1908A	14	Oklahoma City	Supervising-Surveying-Spraying, Res.	270

TIME FLOWN BY STATES IN 1953
for
AIRCRAFT HEADQUARTERED AT OKLAHOMA CITY



EXPERIMENTAL ACTIVITIES

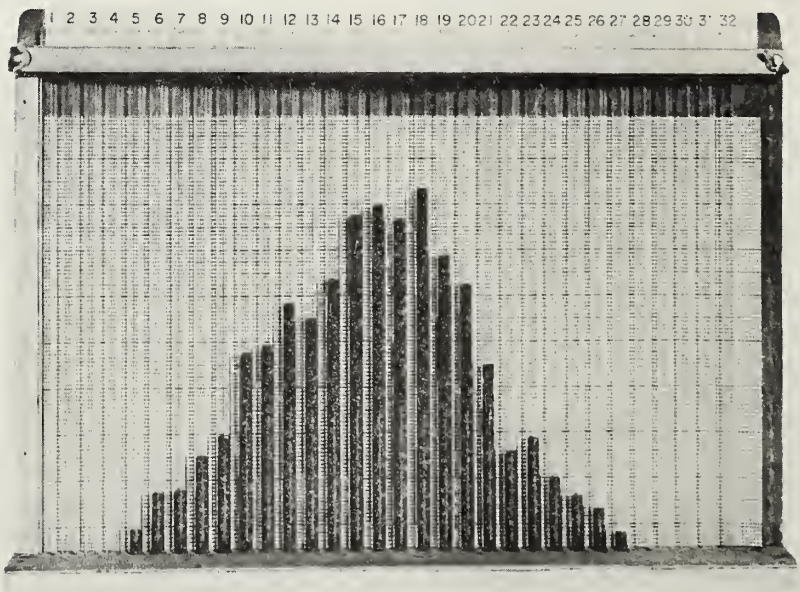
Aircraft and Special Equipment Center

The potential importance of granulated insecticides has indicated that equipment should be developed to apply them. For this reason the Center modified the dispersal equipment of both standard-model Stearman airplanes so that they could be used for applying granulated materials as well as for spraying.

Experience during 1952, in making experimental applications of granulated materials, indicated the need for a simple method of calibrating dispersal equipment. During that year paper plates or shallow trays were placed across the line of flight to collect deposits and appraise them for swath distribution. This method had definite shortcomings in that some of the material bounced out of the plates and trays. At times some of it was carried away even by low velocity wind. For this reason the following improved system for measuring deposits was developed during 1953.

For collecting deposits, light-weight round aluminum funnels with tops measuring 1/2 square yard in area, were constructed. A detachable iron stake was devised to hold each funnel in a fixed position. A paper cup placed under the funnel outlet, which holds it in place, collects the material. The sloping sides of the funnel prevent falling granules from bouncing out of it and the cups shield the collected material from the wind.

The across-swath deposit is appraised quickly through the use of a device consisting of a series of small glass tubes mounted vertically close to a background board. Deposits collected in the numbered cups are poured into these tubes of corresponding numbers and the amount of material in each tube marked on graph paper slipped behind the tubes. These marks are connected to give a deposit curve.



Due to the anticipated use of impregnated granulated material for white-fringed beetle control, experiments were conducted using a Buffalo turbine blower to broadcast 30-60 mesh attaclay. Results of these tests were furnished the White-Fringed Beetle Control Project. Also tested was a rotary bait-broadcaster of the type formerly used for grasshopper and Mormon cricket control. In addition, a hand-operated rotary seeder, received from White-Fringed Beetle Control for evaluation, was tested and modified. R. A. Tate, the Center's liaison in Region II, came to Oklahoma City to assist with some of this work. After completion of the tests, the Buffalo blower, the bait-broadcaster and hand-seeder were shipped to Gulfport, Mississippi for field evaluation.

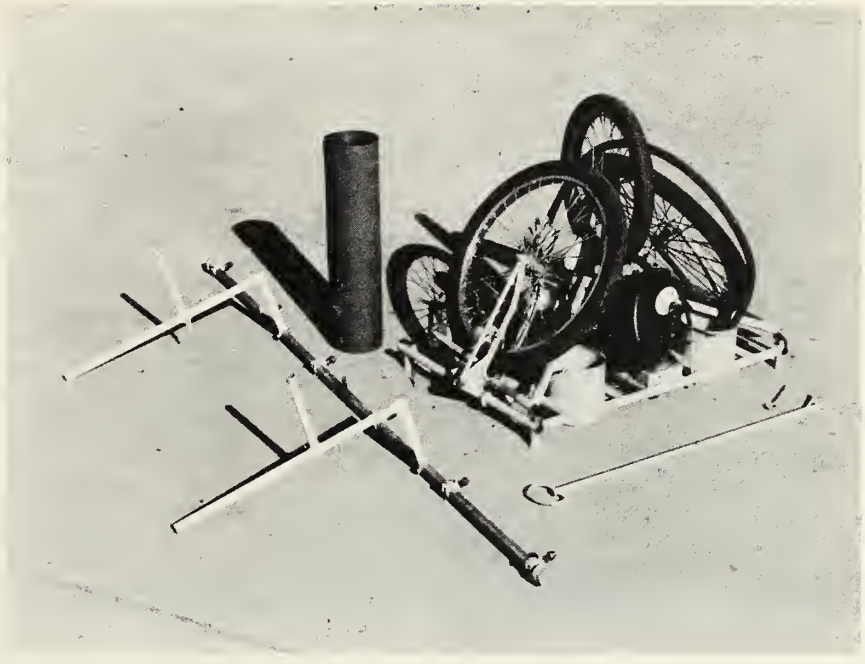
Cereal and Forage Insect Investigations

The sugarcane rootworm problem was discussed with Ralph Mathes at Houma, Louisiana. If research in controlling the sugarcane rootworm by injections of insecticides into the soil surrounding the roots proves effective, there may be a need for a machine which will make the proper injections while traveling along the crop row.

The rice stink-bug control problem was discussed with R. W. Helm at Crowley, Louisiana. Following preliminary cage experiments for the control of the stink-bug at the Rice Experiment Station, experiments using aerial-applied sprays on a field scale were contemplated. A sprayer-equipped airplane owned by a local applicator was inspected and modifications recommended to prepare it for the tests.

Arrangements were made early in 1953 to furnish the Cereal and Forage Insect Investigations Laboratory at Bozeman, Montana with a small plane for experimental applications of sprays for Mormon cricket control in Nevada. A Stearman and pilot were so assigned during May.

A small hand-drawn three-wheeled boom-type sprayer was built in the Center's shop for the Cereal and Forage Insect Investigations Laboratory at Stillwater, Oklahoma. The unit is similar to other shop-built test-plot sprayers with bicycle-type wheels. However, the outstanding virtue of this unit is that it can be so folded as to be easily loaded through the rear door of a panel-delivery truck. Because of this feature, as well as other desirable characteristics, its description will be presented for publication.



White-Fringed Beetle Control

A rotary-vane type of pump furnished by an equipment distributor was tested in an effort to find a pump with a longer operational life for use on white-fringed beetle spraying equipment. Through the cooperation of the White-Fringed Beetle Project, the pump was tested but it proved less serviceable than those in use.

Truck Crop and Garden Insect Investigations

At the request of J. C. Chamberlin of the Forest Grove laboratory, Super-Cub #14 was flown to Oregon in August. Personnel at the laboratory conducted tests evaluating its spray equipment and comparing its effectiveness with the heavier N3N.

SURVEY ACTIVITIES

Survey work in 1953 greatly exceeded that of previous years. Because of the expected increase of such work in 1953, a Cessna 180 was acquired.

This airplane, first manufactured early in 1953, offered many improvements over the 170Bs purchased in 1952. Its purchase in June 1953 brought the total number of Bureau planes available for surveying, scouting and supervising to five. Their type and location is as follows:

Type	Location
Cessna 195	Beltsville
Cessna 180	Oklahoma City
Cessna 170B	Oklahoma City
Cessna 170B	Portland
Piper Super Cub	Oklahoma City

A brief summary of the survey work performed in 1953 follows.

A Cessna 170B and pilot were furnished for a Douglas-fir blowdown bark beetle survey conducted in Oregon and Washington during May and June 1953 by the Portland Forest Insect Laboratory, the Pacific Northwest Forest and Range Experiment Station and the U. S. Forest Service.

Size of acreages surveyed approximated those of the previous year but the number of airplanes and crews required was reduced from four to two.

Before the survey began, the right door of the Center's Cessna 170B was made jettisonable. The shoulder harnesses were modified to provide a strap over each shoulder of all crew members instead of over one shoulder only, as originally provided by the Cessna factory. This was done to assure that the crew would not roll out of the harnesses in the event of a crash.

Special quick-opening back-pack parachutes were borrowed from the Air Force. Emergency kits, including first-aid supplies and 100 feet of rope, were assembled and attached to the parachutes.

The survey crews were sent to the U. S. Forest Service smoke-jumper school to practice bail-out procedures and simulated let-downs from tall trees. To practice bail-out procedure, each crew member wearing his parachute and holding his map-board and maps was seated in the parked airplane with his seat belt and shoulder harness fastened. A mattress was placed on the ground beneath the right door. At a given signal, the door was jettisoned, maps and boards were discarded, belts and harnesses were unfastened and the crew bailed out in order. After practice, it required only 25 seconds to evacuate and clear the airplane.

A regional survey to chart the forest insect damage on all timbered land in the State of Washington was conducted during 1953. The Cessna 170 and pilot were assigned to this work. It was performed at the completion of the Douglas-fir blowdown bark beetle survey in Oregon in cooperation with the Bureau's Portland Forest Insect Investigations Laboratory, the U. S. Forest Service and the Washington State Forest Service.

A regional survey of the forest insect damage on federal, state and privately-owned timberlands in California was conducted during September and October 1953. A Cessna 170B and pilot were assigned to this survey. The Forest Insect Investigations Laboratory in Berkeley, California directed the work, with the U. S. Forest Service, California State Division of Forestry and the National Park Service cooperating. Seldom during this survey was it possible to carry three observers. Often only one could accompany the pilot because so much of the flying had to be done at high elevations. Little flying was done below 8,000 feet and numerous flights above 13,000 feet were required.

The Cessna 180 and pilot were assigned to the regional forest insect survey in Arizona and New Mexico, conducted in September and October 1953 by the Albuquerque Forest Insect Investigations Laboratory.

The Regional Chief, Division of Forestry, Bureau of Land Management, U. S. Department of Interior, Portland, Oregon, requested the services of a Cessna airplane and pilot to examine areas of windthrown and beetle-infested timber in each of their Forest Districts of Oregon. This was in preparation for a 1954 salvage timber sale program. Since this survey had a direct relationship to insect control, a plane and pilot were assigned to the work during August.

A Cessna 170B and pilot were provided during July for a larch sawfly survey in Minnesota and Wisconsin, conducted by the Forest Insect Laboratory at Milwaukee, Wisconsin.

The gypsy moth aerial defoliation survey was made in June and July following the completion of the gypsy moth control program. The Piper Super Cub airplane and a pilot-supervisor were furnished for this assignment. Preliminary inspection showed larger areas

of defoliation than in 1952. Therefore a second airplane and pilot were hired to insure completion of the survey before refoliation of the trees made it difficult to observe the damage. The survey was in Connecticut, Maine, New Hampshire, Rhode Island, Vermont, New York and Massachusetts.

The aircraft used on these surveys were all single-engine high-wing monoplanes. Even with the utmost safety precautions, such surveys are hazardous. The lives of all crew members would be jeopardized by an engine failure. Although the Cessna 180 performed better than the 170B under similar conditions, practically all hazard could be eliminated by using a high-performance twin-engine airplane. The advantages of such an airplane are especially significant in the heavily timbered areas where most of the Bureau's aerial surveys are conducted.

Keeping in mind the safety advantage of two engines, a review was made of a twin-engine high-wing aircraft currently manufactured. It was found that the Aero-Commander, built by the Aero Design and Engineering Company, is the only one that has the qualifications necessary for aerial survey work. A visit was made to the factory to obtain detailed information on the airplane and a demonstration of its performance, including single-engine and slow-flight characteristics.

AIRCRAFT MAINTENANCE AND MODIFICATION

To increase aircraft operational safety, it was planned early in 1952 to equip all planes at the Center with two-way radios. Because of budget limitations, this was projected over a two-year period and was not fully accomplished until the beginning of the control season in 1953. The planes purchased for research, survey and scouting were delivered with factory-installed radios.

Radios are used to file and close flight plans with CAA radio communication stations, to transmit position reports while enroute, for air navigation, to receive current weather information and notices to airmen that are broadcast by CAA stations twice every hour, and to receive instructions from airport control towers. It is also possible for the pilot of one airplane to communicate with pilots of others while in flight, providing they are not more than 100 miles apart.

This radio project is of current importance because the Bureau's aircraft are now more fully utilized than formerly. Cross - country flying requirements have increased due to the aircraft being used for work arising anywhere in the United States instead of being restricted largely to the local work of one project.

At the time the Center was established, the aircraft that were retained were of various colors--yellow, silver, red and silver, and blue and yellow. It was decided to standardize both color and design. Because much of the flying is done in isolated areas, often over mountainous and timbered country, a high-visibility yellow was selected as the predominant color.

The top of the fuselage forward of the windshield, the bottom of the fuselage, and the nose are painted blue-green. The insignia appearing on the front cover of this report is also painted on the forward cowl at each side of the fuselage.

In an effort to evaluate the use of "splates" (vertical fins) attached to squared wing-tips, suggestions were solicited from the Aeronautical Engineering Department of the Massachusetts Institute of Technology. The advice offered was that any benefit derived from splates would not necessarily justify reworking aircraft wing-tips to a square form. However, if the wing-tips were already square, the wing-tip vortex action would be reduced slightly by the installation of splates.

Investigation was commenced on the use of fire-resistant fluids in hydraulic drive systems for use in operating aircraft spray pumps. Aerial applicators in one state reported that fire involving spray aircraft with hydraulic drive systems had caused some insurance companies to quote a higher rate for aircraft so equipped. Tests are now being made with a non-flammable replacement fluid to determine whether it can be recommended.

Continued efforts are being made to simplify and lighten the hydraulic drive systems now used to operate aircraft spray and dust equipment. A "closed" system similar to the one devised by V. O. Young, agricultural engineer at Forest Grove, Oregon, is under test. If a "closed" system proves successful it could be used on light aircraft since it is lighter and less bulky than systems in current use.

Douglas #1.

As a safety measure an electrically-driven fuel-booster system was incorporated into the aircraft's fuel system. It replaces two hand-operated emergency fuel-pumps. The fuel-boosters are used during all take-offs and landings, these being the most critical times to lose fuel pressures.

The week before the two Douglas C-47s were to leave Oklahoma City for their first 1953 field assignments, their control surfaces were damaged by a severe hailstorm. The metal skin of the fuselages and wings was dented, but not seriously.

Douglas #1 received the most damage. There were so many holes in the fabric-covered elevators and ailerons that it was impractical to patch them. Neither was there time enough to recover them without delaying field work. The CAA Aeronautical Center therefore loaned one set of controls until the damaged set could be recovered.

All heavy maintenance on this airplane had been completed in the fall of 1952.

Douglas #2.
The hail damage to the control surfaces of this airplane were repaired within a few days.

The same type of electrically-driven fuel-booster system as was installed in Douglas #1 was built into this airplane.

The spray system was modified as follows to incorporate several safety features and improve its design: Two hydraulically-operated emergency dump valves, capable of emptying approximately the full load of 800 gallons in one minute, were installed. The tank venting system was modified so that dumping would not be restricted. The old rubber tank-liners in the two insecticide tanks were replaced.

Previously, the spray pressure was produced with a gasoline engine-driven pump located at the rear of the fuselage cargo section. While this system always worked well, it was necessary to carry an additional crew member to guard against fire and keep the engine running properly. The gasoline engine and pump were replaced with two hydraulically-driven centrifugal pumps. Either of the two pumps can continue to spray out the load should one or the other fail. They are controlled from the cockpit.

The loading system was modified so that the insecticide can be loaded without climbing on the wings. Tubing from the tank inlets was extended through the airplane's skin on the lower left side of the fuselage, behind the wing, where two 2-inch quick-disconnect couplings were attached. Modifying the loading system in this way permitted the loading crew to be reduced by at least two men.

DESCRIPTION OF BEPQ AIRCRAFT
U.S. Department of Agriculture — December 31, 1953

Type and CAA Number	BEPQ No.	Headquartered At	Engine Mfr.	Total H.P.	Special Equipment: Hopper Cap. Cu.Ft.	Special Equipment: Tank Cap. Gal.	Special Equipment: Pump Type	Special Equipment: Driven By
Douglas 75029	1	Oklahoma City	P & W	2400	585	1020	Centrifugal	Hydraulics
Douglas 816	2	Oklahoma City	P & W	2400		922	Centrifugal	Hydraulics
Cessna 2234D	3**	Oklahoma City	Cont.	145				
Cessna 9354A	4*	Beltsville	Jacobs	300				
Cessna 2494D	5*	Portland	Cont.	145				
Stearman 55692	6	Oklahoma City	P & W	450	26	195	Centrifugal	Hydraulics
Stearman 1380V	7	Oklahoma City	Lycoming	300		130	Centrifugal	Hydraulics
Stearman 9487H	8	Beltsville	Lycoming	220		80	Cent.& Gear	Wind & Eng.
Stearman 9488H	9	Beltsville	Lycoming	220		70	Centrifugal	Wind
Stearman 1218N	10	Oklahoma City	P & W	450	23	170	Centrifugal	Hydraulics
N3N 45009	11	Oklahoma City	P & W	450	23	90	Centrifugal	Wind
Cessna 1643C	12**	Oklahoma City	Cont.	225				
N3N 45036	13	Forest Grove	Lycoming	300	15			Wind
Piper 1908A	14	Oklahoma City	Cont.	125	18	100	Gear	Wind

* Aerial photographic equipment installed.
** Used for survey and supervisory work on Bureau and cooperative assignments.

Cessna 170B #3.
Minor maintenance was required on this airplane. A thorough inspection was performed to ready it for another season. The striping and trim were removed, and the airplane was painted to conform to the new paint design.

Cessna 195 #4.
Assigned to the Division of Forest Insect Investigations, Beltsville, Maryland.

Cessna 170B #5.
Assigned to the Division of Forest Insect Investigations, Portland, Oregon.

Stearman #6.
It has become increasingly difficult to procure new hydraulic master-cylinder parts for the wheel brakes. Therefore, an automotive hydraulic master cylinder was adapted and installed. It has performed well.

The radio transmitter and receiver were stolen from this airplane while it was on a spraying assignment in Colorado. The loss was reported to the FBI and is being investigated.

Following the policy of equipping as many as possible of the Center's aircraft for any type of work assignment, it was decided to install a combination spray-dust unit in this airplane. Previously it had been equipped as a sprayer. Rather than build one in the shop it was decided to purchase a standard unit from a commercial manufacturer. It has a liquid-tight hopper, built of aluminum sheet metal and lined with plastic-coated fiber-glass. Its capacity is 26 cubic feet or 195 gallons.

This airplane had been painted yellow when it was refinished in 1952. The trim and insignia of the new standard design were added.

Stearman #7.
A 300 hp Lycoming engine was installed in this airplane to replace the 225 hp engine that was found to be insufficient for the high-lift configuration.

The entire airplane had originally been painted yellow. The trim and insignia of the new standard color design were added.

Stearmans #8 and #9.
Assigned to the Division of Forest Insect Investigations, Beltsville, Maryland.

Stearman #10.
The fuselage of this airplane was covered with aluminum sheet. All of the original fairing was replaced with a simple aluminum-angle fairing that eliminated the original compound curves. By doing this, a flat belly was easily incorporated to simplify attachment of a spreader. This simplified form also permitted larger pieces of sheet metal to be used, thus saving considerable cutting, fitting, riveting and labor.

A dustproof bulkhead was installed behind the pilot's seat to prevent insecticidal dusts from being drawn into the cockpit through the rear of the fuselage. A streamlined headrest was installed behind the pilot's seat to further reduce air turbulence in the cockpit.

Full length removable panels were installed on the left side of the fuselage, and from the engine to the cockpit on the right side. This makes it possible to readily and thoroughly inspect and clean the inside of the fuselage. It also permits the exposure of a large portion of the cockpit and hopper areas for exhibition purposes or for repairs and modifications of the dispersal installation.

A hydraulic brake system similar to that described for Stearman #6 was installed in this airplane.

The wing fabric was rejuvenated, the tail assembly covered with new fabric and both doped and painted. The new standard colors and design were applied.

The 300 hp Lycoming engine that originally had been installed in this airplane was needed for the high-lift Stearman #7 and a 450 hp engine was more desirable for this airplane, therefore a new engine mount and a 450 hp Pratt & Whitney Wasp engine were purchased and installed. Baffles between the cylinders and cowling were installed in accordance with recent CAA and Pratt & Whitney factory recommendations.

At the time this airplane was transferred to the Center, it had no dispersal apparatus installed in it. A liquid-tight hopper-tank made of fiber-glass, bonded with polyester plastic was purchased. It and other necessary components for a combination spray-dust unit were installed. The hopper-tank has a capacity of approximately 23 cubic feet or 170 gallons.

With an ordinary duster-type airplane, the flow rate will vary during the application of a load of dust even though the hopper-gate is set for a specific application rate. An experienced duster pilot therefore often adjusts the hopper gate while in flight to equalize the flow rate. By watching the dust cloud behind the airplane, experience has taught him how much adjustment is necessary. Inexperienced duster pilots therefore must learn this procedure, which can be learned only through practice. During this learning period, the amount of dust they apply may be too little or too great, resulting in failure to get complete control of the pests or in a waste of material.

To remedy this variable flow rate, a positive-flow metering-system, similar to that used so successfully in Douglas #1, was built and installed to drive the

metering valve. Through the adjustment of a tapered on-off control valve, the speed of the metering valve and the rate of discharge can be regulated by the pilot and various prescribed amounts of materials applied. A tachometer mounted in the instrument panel indicates the rpm at which the metering valve rotates.

When the airplane is used as a sprayer, the same hydraulic system that drives the metering valve is used to drive the spray pump.

Tests of the metering valve and its hydraulic drive system were conducted in the shop, using dust and 30/60 mesh attaclay. Following the shop tests, a vaned fantail spreader was attached and flight tests were made.

Following these tests, a variable fantail type spreader without vanes was built. It was designed so that the width and depth of the spreader outlet could be increased or decreased. The vanes inside the spreader were omitted to determine whether a uniform swath could be produced at varying application rates without vanes and whether the vanes affect the width of swath.

N3N #11.

The wing and tail-surface fabric of this airplane was in poor condition and therefore replaced before the airplane was sent into the field for another season's work. The wing and tail-surface fabric of N3N #12 which was to be disposed of was in excellent condition. Therefore the wings and tail surfaces of the two airplanes were interchanged. This required only a few days and saved the materials and labor necessary to recover those of #11. Otherwise, the airplane was in good condition and needed only a thorough inspection to ready it for another season.

N3N #12 and its replacement, Cessna 180 #12

Another observation airplane was needed to handle the additional survey flying and supervisory work that was contemplated. N3N #12 was sold and the proceeds used toward purchase of a new Cessna 180. The Cessna 180, fully loaded, can fly at speeds ranging from 60 to 160 miles per hour, climb more than 1,100 feet per minute and has a ceiling of almost 20,000 feet. During the various forest insect surveys in 1953, this new-model airplane carried a full crew of four on all flights. Delivery was accepted at the factory in June. It was ordered without paint or striping and later painted to conform with the new design and color.

N3N #13.
Assigned to the Division of Truck Crop and Garden Insect Investigations, Forest Grove, Oregon.

Piper Super Cub #14.
A standard factory combination spray-dust installation was purchased in July. During the late summer, the airplane was flown to Forest Grove, Oregon. Personnel of the Division of Truck Crop and Garden Insect Investigations and the Bureau of Plant Industry, Soils and Agricultural Engineering, working jointly, installed the spray system and ran spray tests to compare application patterns. Results of the tests have been reported by J. C. Chamberlin.

VEHICLE INVENTORY (See next page)

VEHICLE INVENTORY

This inventory covers vehicles located at Oklahoma City and all Bureau aircraft.

On Hand January 1, 1953

Type	Reg. No.	EPQ No.	Location
Douglas	N75029	1	Okla. City
*Douglas	N816	2	Okla. City
Cessna 170B	N2234D	3	Okla. City
Cessna 195	N9354A	4	Beltsville
Cessna 170B	N2494D	5	Portland
Stearman	N55692	6	Okla. City
Stearman	N1380V	7	Okla. City
Stearman	N9487H	8	Beltsville
Stearman	N9488H	9	Beltsville
Stearman	N1218N	10	Okla. City
N3N	N45009	11	Okla. City
N3N	N45266	12	Okla. City
N3N	N45036	13	Forest Grove
Piper Super Cub	N1908A	14	Okla. City
Ford Sedan '50	A41771		Okla. City
Ford Sedan '52	A44404		Okla. City
Ford Pickup '50	A35357		Okla. City
Internat'l 2T Truck '50	A36723		Okla. City
Towmotor Fork Lift	10353634		Okla. City
Farmall Tractor	A3359		Okla. City

*On lease from the Navy Department.

Purchases - 1953

Type	Number	Location
Cessna 180	N1643C	Okla. City

Disposals - 1953

Type	Number	Location	Disposition
N3N	N45266	Okla. City	Trade-in on Cessna 180

On Hand December 31, 1953

Type	Reg. No.	EPQ. No.	Location
Douglas	N75029	1	Okla. City
*Douglas	N816	2	Okla. City
Cessna 170B	N2234D	3	Okla. City
Cessna 195	N9354A	4	Beltsville
Cessna 170B	N2494D	5	Portland
Stearman	N55692	6	Okla. City
Stearman	N1380V	7	Okla. City
Stearman	N9487H	8	Beltsville
Stearman	N9488H	9	Beltsville
Stearman	N1218N	10	Okla. City
N3N	N45009	11	Okla. City
Cessna 180	N1643C	12	Okla. City
N3N	N45036	13	Forest Grove
Piper Super Cub	N1908A	14	Okla. City
**Ford Sedan '50	A41771		Okla. City
Ford Sedan '52	A44404		Okla. City
Ford Pickup '50	A35357		Okla. City
Internat'l 2T Truck '50	A36723		Okla. City
Towmotor Fork Lift	10353634		Okla. City
Farmall Tractor	A3359		Okla. City

*On lease from the Navy Department
**Loaned to Mexican Fruit Fly and Citrus Blackfly Control.